

Risk-Based End State Vision for the Idaho National Engineering and Environmental Laboratory Site (Draft)

1. INTRODUCTION

The Secretary of Energy's *Top-to-Bottom Review for the Environmental Management Program* (DOE 2002a) examined the Environmental Management (EM) cleanup program and concluded that "the EM Program's major emphasis has been on managing risk, rather than actually reducing risk to workers, the public, and the environment." The recommendations in the report focused on accelerating risk reduction and cleanup at EM sites. In July 2002, U.S. Department of Energy Idaho Operations Office followed the report with the *Environmental Management Performance Management Plan for Accelerating Cleanup of the Idaho National Engineering and Environmental Laboratory* (hereinafter referred to as the *Performance Management Plan*) (DOE-ID 2002a). The plan described a strategy for significantly accelerating cleanup at the Idaho National Engineering and Environmental Laboratory (INEEL) Site. Accelerating cleanup at the INEEL will reduce the risk of contamination of the Snake River Plain Aquifer from radioactive and hazardous waste. It also will reduce the risk to workers, the environment, and the public by cleaning up, stabilizing, and disposing of waste decades sooner than previously planned.

To address concerns identified in the *Top-to-Bottom Review for the Environmental Management Program* (DOE 2002a), the U.S. Department of Energy (DOE) issued a policy on "Use of Risk-Based End States" (DOE P-455.1, 2003). The policy is based on the premise that effectiveness of cleanup programs can be improved by focusing efforts on cleanup that is aimed at, and achieves, clearly defined, risk-based end states. Risk-based end states are representations of site conditions that are based on the planned future land use of the property and are protective of human health and the environment consistent with that use.

The policy requires that each DOE site undergoing cleanup prepare a risk-based end state vision (RBESV) in cooperation with regulators and in consultation with affected governments, tribal nations, and stakeholders. Once the RBESV is finalized, sites are expected to evaluate their cleanup activities and strategies to determine if it is appropriate to change site baseline documents and renegotiate agreements. The RBESV is not a decisional document. It describes a vision for the INEEL at the end of the EM cleanup mission and serves as a means to initiate dialog with stakeholders, regulatory agencies, and the public on that vision.

The final version of this document will present the RBESV for the INEEL Site at the completion of the EM cleanup program based on future land-use projections developed through public meetings and consultation with regulators (i.e., the state of Idaho and EPA), regional government entities (e.g., Shoshone-Bannock tribes and city and county representatives), INEEL Citizens Advisory Board, and special interest groups. The end state vision is based on the premise that access to the INEEL will remain under federal U.S. government control. Cleanup objectives will be based on this premise along with other factors, such as protectiveness, cost, and technical feasibility. When all active EM cleanup activities have been completed, which is expected to take place by 2035 or sooner, responsibility for operation and long-term stewardship of the Site will be transferred to DOE's lead program secretarial office (LPSO) for the INEEL or to other appropriate DOE programs. The current LPSO for the INEEL Site is the Nuclear Energy, Science, and Technology Office of DOE (NE).

There is one exception to the 2035 timeframe for the end state vision. At some facility areas, groundwater monitoring and groundwater remediation are expected to continue beyond 2035. The goal

for DOE's selected Snake River Plain Aquifer remedial actions has been to be below maximum contaminant levels (MCLs) in the aquifer by 2095. Therefore, 2095 is considered the end state timeframe for discussions related to groundwater remediation. The DOE LPSO will assume responsibility for those activities as well as for future cleanup activities upon completion of the EM mission. In addition, there are some areas where institutional controls will be required beyond 2035. The DOE LPSO will assume responsibility for this scope as well.

It is important to recognize that the RBESV does not describe the Site at the end of the DOE mission but rather at the end of the EM cleanup mission. The INEEL Site is expected to have a long-term future mission as a nuclear energy research and development site. The document does not contain projections about the nuclear energy development activities or work force, as non-EM operations at the INEEL are outside the defined scope of this document.

Once the RBESV has been developed, previously established cleanup strategies will be evaluated to ensure that they are consistent with the end state vision and the future, intended use of the Site. Some potential variances between the risk-based end states depicted in this document and current cleanup plans and requirements have been identified in Section 5 of this document. At this time, no decisions have been made regarding the variances; they are simply cleanup activities that the DOE believes merit further evaluation to determine if they are necessary and a wise expenditure of taxpayer dollars. Cost-benefit analyses and risk assessments will be needed to evaluate whether the variances are worth pursuing and to ensure that the proposed alternatives are protective of human health and the environment.

In cases where DOE determines that current cleanup plans are not consistent with the future land-use vision, DOE will work with the appropriate regulatory agencies to negotiate modifications, as needed, to cleanup strategies, agreements, and baselines. The DOE will continue to comply with applicable legal and regulatory requirements. The land-use vision in this document also will be used for future risk assessments, selecting remedial actions, and determining cleanup levels required to protect human health and the environment.

Several compliance agreements, amendments, and consent orders executed between 1991 and 2000 govern the EM cleanup work at the INEEL. The primary agreements are summarized below:

- Federal Facility Agreement and Consent Order (FFA/CO)—In November 1989, the U.S. Environmental Protection Agency (EPA) listed the INEEL on the National Priorities List of the National Oil and Hazardous Substances Pollution Contingency Plan. As a result, the INEEL became subject to the cleanup requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (DOE-ID 1991a) between the DOE, EPA, and Idaho Department of Environmental Quality (IDEQ) established a strategy and plan for cleanup at the INEEL in accordance with CERCLA. The INEEL was divided into 10 waste area groups (WAGs) based on similar characteristics or geographic boundaries. Nine groups generally correspond to the Site's major facility areas. The tenth group assesses overall risk to the aquifer beneath the Site, addresses sites outside the boundaries of INEEL's primary facility areas, and allows for inclusion of newly identified release sites. These WAGs are further divided into operable units (OUs). Under the FFA/CO, the DOE conducts an environmental investigation at each site that may be contaminated. At the end of each investigation, if it is determined the area needs cleanup, a proposed plan that documents the results of the investigation and proposes alternative cleanup actions is presented for public comment. After reviewing and addressing any comments, the DOE, EPA, and State of Idaho reach a final decision, which is documented in a record of decision (ROD). Cleanup design and construction can then begin.

- Notice of Noncompliance Consent Order—*The Notice of Noncompliance Consent Order* (IDEQ 1992) is an agreement between the DOE, IDEQ, and EPA that establishes actions and milestones to resolve 1989 EPA Resource Conservation and Recovery Act (RCRA) inspection issues, including configuration of stored transuranic waste and high-level waste in the Idaho Nuclear Technology and Engineering Center (INTEC) tank farm.
- Settlement Agreement—The *Settlement Agreement* (DOE 1995) between the DOE, State of Idaho, and U.S. Navy resolved a lawsuit regarding the receipt of spent nuclear fuel at the INEEL. The agreement specifies milestones toward the removal of all spent nuclear fuel and certain radioactive waste from INEEL by 2035.
- Site Treatment Plan—In fulfillment of the 1992 Federal Facilities Compliance Act, the INEEL prepared *Idaho National Engineering Laboratory Site Treatment Plan* (DOE-ID 1995b) to address the long-term storage of waste that contains both chemical and radioactive materials. This enforceable plan was approved by the State of Idaho and is updated annually.
- Voluntary Consent Order (VCO)—*The Consent Order* (IDEQ 2000) is an enforceable agreement with IDEQ that governs resolution of self-disclosed RCRA issues, most of which were related to the closure of 912 tanks and tank systems.

Public documents that contain additional detailed information on planned land use, environmental impacts, and remediation plans and strategies include the *Idaho National Engineering and Environmental Laboratory Comprehensive Facility and Land Use Plan* (DOE-ID 1996), the *Performance Management Plan* (DOE-ID 2002a), *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement* (hereinafter referred to as *Final Environmental Impact Statement*) (DOE 2002b), and *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE-ID 1995c). Other information sources include RCRA closure plans and a number of CERCLA documents.

1.1 Organization of the Report

Section 1 of this report provides general, introductory information related to this document; a summary of the INEEL's past, current, and future missions; and a brief discussion of the types of hazards and contamination at the Site. Section 1 also provides an overview of the Site cleanup strategy, priorities, and remaining cleanup work.

Section 2 provides information on the region surrounding the INEEL. Maps and narratives describe physical characteristics and human and ecological land use for the region surrounding the INEEL.

Section 3 provides information on physical characteristics, human and ecological land use, legal ownership, and population of the INEEL Site and areas next to the Site. Maps and narrative for Sections 2 and 3 depict both the current state and the risk-based end state.

Section 4 provides information on eight separate "hazard areas" at the Site. A hazard area is a portion of the Site that contains hazards that present risks to human health or the environment (e.g., contaminated soil, entombed facilities, contaminated groundwater plumes, or buried waste). In general, the hazard areas correspond to WAGs established in the FFA/CO; however, information on other planned closure activities, such as RCRA closures; VCO activities; and deactivation, decontamination, and decommissioning (DD&D), is also provided. Each of the eight hazard area subsections in this document contains a brief narrative description followed by a map and a conceptual site model depicting

the current hazards. These are followed by a map and conceptual site model that reflect anticipated conditions at the end state. Differences between current state and risk-based end state are discussed in the narrative.

Conceptual site models provide, in block diagram form, information regarding the hazards, pathways, receptors, and barriers (current and planned) between the hazards and receptors. The conceptual site models, which were prepared during baseline risk assessments and published in approved CERCLA documents, have been updated to reflect current (2003) conditions and modified to show anticipated conditions at the end state.

In some cases, potential variances between the RBESV and current cleanup decisions for the INEEL have been identified. These variances are discussed in Section 5.

Section 6 contains a list of references used in this document.

1.2 Site Mission

The INEEL Site began its mission during World War II when the U.S. Navy withdrew 270 square miles in Southeast Idaho from the public domain for use as a gunnery range. In 1950, the U.S. Atomic Energy Commission (the predecessor to the DOE) obtained the Navy's gunnery range and established the site as the National Reactor Testing Station.

Lands were added later for use in developing and testing nuclear reactors and support facilities. Over the years, personnel at the Site have designed and tested 52 reactors, the world's largest concentration. Most of them were first-of-a-kind reactors, and many made significant contributions to what were then the newly developing fields of reactor safety and design. For example, the Experimental Breeder Reactor I, which is now a National Historic Landmark, was the first reactor in the world to generate electricity. Three nuclear reactors are still operable today. The Advanced Test Reactor (ATR) at the INEEL's Test Reactor Area (TRA) is used for materials testing and the production of medical and industrial isotopes. The other two operable reactors are the ATR Criticality Facility at TRA, which is a full-scale, low-power version of the ATR designed to provide physics data, and the Neutron Radiography Reactor at Argonne National Laboratory-West (ANL-W).

The INEEL received its first shipments of DOE-owned spent nuclear fuel from nuclear weapons production reactors at the Hanford Site in Richland, Washington, in 1952. In 1957, the Navy began shipping spent nuclear fuel from nuclear-powered submarines and warships to the INEEL. Spent nuclear fuel was reprocessed to recover highly enriched uranium for reuse in the nation's weapons program from 1953 to 1992.

From 1954 through 1970, over 67,000 m³ of transuranic waste, mostly from the Rocky Flats Plant in Colorado, were disposed of in the Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex (RWMC).

In 1974, the National Reactor Testing Station was renamed the Idaho National Engineering Laboratory to reflect an expanded mission, including waste management, environmental engineering and restoration, and development of advanced technologies and methods related to energy efficiency, renewable energy, national security and defense, and nuclear materials. In 1997, the Site was renamed the Idaho National Engineering and Environmental Laboratory to reflect its increased mission focus on environmental cleanup and research and development of related technologies.

In July 2002, Secretary of Energy Spencer Abraham announced a major mission realignment for the lab, establishing the Site as the nation's lead laboratory for nuclear energy research and development. Management of the laboratory was reassigned to NE.

Since 1991, the INEEL EM Program has been managing a significant cleanup legacy, including contaminated groundwater, contaminated buildings and soil, and significant volumes of radioactive and hazardous waste.

The INEEL EM Program is responsible for treating, storing, and disposing of waste streams; removing or deactivating facilities that are no longer needed; and cleaning up contamination from past releases that presents a risk to human health or the environment. The INEEL EM Program is scheduled to complete all active cleanup by 2035, at which time operation and maintenance of all INEEL facilities will be transferred to the LPSO for the Site.

1.3 Status of Cleanup Program

In February 2002, the DOE published the *Top-to-Bottom Review of the EM Program* (DOE 2002a). The report concluded that the department should restructure its cleanup efforts to focus on reducing or eliminating environmental risk as quickly as possible. In response to this report, DOE-EM challenged DOE sites to develop plans to change their cleanup strategies from a focus on risk management to an approach that accelerates risk reduction and closure.

In May 2002, DOE, IDEO, and EPA signed a letter of intent formalizing an agreement to pursue accelerated risk reduction and cleanup at the INEEL. This letter of intent identified seven priorities for accelerating cleanup. The seven priorities are (DOE-ID 2002a):

- Continued cleanup and protection of the Snake River Plain Aquifer
- Consolidation of EM activities to INTEC, reducing the actively managed EM footprint by over 51%
- Removal and stabilization of sodium-bearing liquid waste from the INTEC tank farm and RCRA closure of the high-level waste tanks
- Placement of all DOE spent nuclear fuel managed by EM into dry storage
- Transfer of all special nuclear material managed by EM to other sites
- Completion of shipments of stored transuranic waste required by the *Settlement Agreement* (DOE 1995)
- Making significant progress in remediation of the buried waste in accordance with the comprehensive remedial investigation/feasibility study (RI/FS) and ROD for the SDA.

In July 2002, the *Performance Management Plan* (DOE-ID 2002a) was published. This document defines the INEEL EM Program vision as “By 2012, the INEEL will have achieved significant risk reduction and will have placed materials in safe storage ready for disposal. By 2020, the INEEL will have completed all active cleanup work with potential to further accelerate cleanup to 2016.”

In mid-2003, the INEEL was restructured into two distinct business units—one for cleanup activities and one for laboratory missions. This was done to allow each organization to focus on its

distinct mission. The laboratory (to be renamed the Idaho National Laboratory in February 2005) will focus on nuclear technology development, and the INEEL EM Program will focus on cleaning up historic contamination at the Site as quickly and efficiently as possible.

Funding for the INEEL EM Program will be prioritized to expedite those activities that significantly reduce risk at the INEEL. Risk analyses based on realistic future land-use scenarios will be used to evaluate the extent of cleanup needed to protect human health and the environment and to establish cleanup requirements. This approach may require reevaluating and negotiating revisions to some previous cleanup decisions that are not consistent with future land use of the Site.

Over the past decade, the following considerable progress has been made toward addressing legacy waste and contamination at the INEEL:

- Of the 596 CERCLA sites identified as being potentially contaminated, 75% have been cleaned up or determined not to pose any risk.
- Over 2 million gallons of high-level liquid waste have been calcined, reducing the volume of liquid waste to approximately 1 million gallons and emptying six of 11 tanks to the heel.
- Stored transuranic waste is being sent for permanent disposal on a routine basis to the Waste Isolation Pilot Plant in New Mexico (more than 3,100 m³ have been shipped).
- Over 29,000 m³ of legacy low-level waste (LLW) have been disposed of, reducing the backlog by 99%, and 3,780 m³ of legacy mixed LLW have been disposed of. The goal is to eliminate the legacy LLW and mixed LLW backlog by the end of 2004.
- 92% of INEEL EM-owned spent nuclear fuel, by weight, has been consolidated into dry storage.
- Substantial masses of volatile organic compounds (VOCs) have been extracted and destroyed from the vadose zone beneath the RWMC.

The following is a summary of the major cleanup activities still remaining at the INEEL Site:

- Treatment of remaining sodium-bearing-waste liquids in the INTEC tank farm and closure of 11 high-level waste tanks and ancillary equipment
- Retrieval, packaging, and preparation of 4,386 m³ of calcine for shipment to an off-Site repository
- Shipment of all DOE-owned legacy spent nuclear fuel to an off-Site repository by January 1, 2035
- Deactivation, decontamination, and demolition of surplus inactive facilities
- Remediation of remaining contaminated sites at the RWMC, INTEC, and Test Area North (TAN).

As cleanup is completed and risk is reduced, further consolidation and footprint reduction will be possible. This will result in lower mortgage costs, which will free up funding for additional cleanup acceleration.

The *Performance Management Plan* (DOE-ID 2002a) states that some activities will continue after 2020: shipment of spent nuclear fuel to a repository; retrieval, treatment, packaging, and shipment of high-level waste calcine to a repository; and final dismantlement of remaining EM buildings. In addition, the Site will continue with ongoing activities, such as groundwater monitoring, well beyond 2020. These activities should be complete by 2035 with the exception of continued remediation of groundwater through monitored natural attenuation and some activities leading to long-term stewardship. Responsibility for groundwater remediation and environmental monitoring will be transferred to the DOE LPSO upon completion of the EM cleanup mission.

More specific information on cleanup strategies, priorities, and milestones is available in the *Performance Management Plan* (DOE-ID 2002a).